NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

POND

NEW YORK

(No.)
CODE NY378

DEFINITION

A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

In this standard, ponds constructed by the first method are referred to as embankment ponds, and those constructed by the second method are referred to as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at spillway elevation is 3 ft or more.

PURPOSE

To provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses, and to maintain or improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

This standard establishes the minimum acceptable quality for the design and construction of ponds if:

1. Failure of the dam will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.

2. The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway. The height of the dam is the difference in elevation, in feet, between the top of embankment and the lowest point on the downstream toe.

3. The effective height of the dam is 35 ft or less, and the dam is low hazard (Class a) as defined in the National Engineering Manual and NYS DEC “Guidance for Design of Dams”.

Site conditions. Site conditions shall be such that runoff from the design storm can be safely passed through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway (service spillway) and an auxiliary spillway, or (3) a principal spillway.

Drainage area. The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough so that surface runoff and groundwater flow will maintain an adequate supply of water in the pond. The quality shall be suitable for the water’s intended use.

Reservoir area. The topography and soils of the site shall permit storage of water at a depth and volume that ensure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. If surface runoff is the primary source of

water for a pond, the soils shall be impervious enough to prevent excessive seepage losses or shall be of a type that sealing is practicable

CRITERIA

General Criteria Applicable To All Purposes

All work planned and applied under this standard shall comply with applicable federal, state and local laws and regulations.

A geologic site investigation shall be conducted in accordance with Part 531-Subpart A-Geologic Site Investigations of the National Engineering Handbook.

Shoreline. Vegetation along the shoreline shall be consistent with the planned usage.

Most of the trees and shrubs in woody areas should be cleared for a width of 25 feet around much of the pond in order to reduce the amount of leaves and organic matter that will enter the pond. Grass or a grass legume mixture should be established and maintained on cleared areas. For wildlife ponds, see Additional Criteria to Provide Water for Fish and Wildlife.

On one-half acre ponds or smaller, at least 50 percent of the shoreline, excluding the earth embankment, shall be graded so that the slope is no flatter than three horizontal to one vertical from normal water to a depth of 4 feet. This same practice is desirable on larger ponds to limit the area available for growth of aquatic vegetation.

Erosion and Sediment Control. An erosion and sediment control plan shall be developed for all disturbed areas. For disturbed areas greater than one acre, the erosion and sediment control plan shall meet the planning, installation, and maintenance requirements of NYS Pollutant Discharge Elimination System General Permit for Storm water Discharges. All Erosion and sediment structures and measures shall be installed prior to earth disturbing activities unless otherwise directed in the construction drawings.

Criteria for Embankment Ponds

Foundation cutoff. A cutoff of relatively impervious material shall be provided under the dam if necessary. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Seepage control. Seepage control is to be included if (1) pervious layers are not intercepted by the cutoff, (2) seepage creates swamping downstream, (3) such control is needed to insure a stable embankment, or (4) special problems require drainage for a stable dam. Seepage may be controlled by (1) foundation, abutment, or embankment drains; (2) reservoir blanketing; or (3) a combination of these measures.

Earth embankment. The minimum top width for a dam is shown in table 1. If the embankment top is to be used as a public road, the minimum width shall be 16 ft for one-way traffic and 26 ft for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority. For dams less than 20 feet in height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in Table 1.

Table 1 - Minimum Top Width for Dams

Dam Height[1]	Storage[2]	Top width
ft	*gallons*	*ft*
<6	any	6
6.1-10	<3 million	6
10.1-14.9	<3 million	8
15-19.9	<1 million	10
6-15	>3 million	10
15.1-24.9	>1 million	12
20-24.9	<1 million	12
25 - 35	Any	14

[1] As defined under "Scope."
[2] Measured to top of dam

Side slopes. The side slopes of the settled embankments shall not be steeper than three horizontal to one vertical. All slopes must be designed to be stable, even if flatter side slopes are required.

Slope protection. If needed to protect the slopes of the dam, special measures, such as berms, rock riprap, sand-gravel, soil cement, or special vegetation, shall be provided.

Freeboard. The minimum elevation of the top of the settled embankment shall be 1 ft above the water surface in the reservoir with the auxiliary spillway flowing at design depth. The minimum difference in elevation between the crest of the auxiliary spillway and the settled top of the dam shall be 2 ft for all dams having more than a 20-acre drainage area or more than 20 ft in effective height.

Settlement. The design height of the dam shall be increased by the amount needed to insure that after settlement the height of the dam equals or exceeds the design height. This increase shall not be less than 5 percent, except where detailed soil testing and laboratory analyses show that a lesser amount is adequate.

Principal spillway. A pipe conduit, with needed appurtenances, shall be installed in all dams except for those ponds in the following categories:

1. Ponds with no entering spring flow and;
   a) 5 acres or less drainage area
   b) 20 acres or less drainage area and 3 feet or less embankment height
2. Ponds where a rock or concrete spillway is used.

The crest elevation shall be no less than 0.5 ft below the crest of the auxiliary spillway for dams having a drainage area of 20 acres or less, and no less than 1 ft for those having a drainage area of more than 20 acres.

When design discharge of the principal spillway is considered in calculating peak outflow through the auxiliary spillway, the crest elevation of the inlet shall be such that the full flow will be generated in the conduit before there is discharge through the auxiliary spillway. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

The capacity of the pipe conduit shall be adequate to discharge long-duration, continuous, or frequent flows without flow through the auxiliary spillways. The size of the principal spillway and associated storage will be designed in accordance with Table 4 of this standard and Chapters 6 and 11 of the National Engineering Handbook. The diameter of the pipe shall not be less than 6 inches and in no case less than those found in Table 2. If the pipe conduit diameter is 10 in. or greater, its design discharge may be considered when calculating the peak outflow rate through the auxiliary spillway.

Table 2 - Size of Principal Spillway

Minimum Diameter of Barrel and Riser (Smooth Steel Pipe)

Drainage Area (acres)	Pipe (Barrel) (Inches)	Diameter of Riser (Inches)
0 – 19	6	10
20 – 39	8	12
40 – 69	10	18
70 – 100	12	18

Pipe conduits under or through the dam shall meet the following requirements. The pipe shall be capable of withstanding external loading without yielding, buckling, or cracking. Flexible pipe strength shall not be less than that necessary to support the design load with a maximum of 5 percent deflection. The inlets and outlets shall be structurally sound and made of materials compatible with those of the pipe. All pipe joints shall be made watertight by the use of couplings, gaskets, caulking, or by welding.

Pipe conduits shall be designed and installed to withstand all external and internal loads without yielding, buckling, or cracking. Rigid pipe shall be designed for a positive projecting condition. Flexible pipe shall be designed for a maximum deflection of 5 percent. The modulus of elasticity for PVC pipe shall be assumed as one-third of the amount designated by the compound cell classification to account for long term reduction in modulus of elasticity. Different reductions in modulus may be appropriate for other plastic pipe materials.

The minimum thickness of flexible pipe shall be SDR 26, Schedule 40, Class 100, or 16 gage as appropriate for the particular pipe material. Connections of flexible pipe to rigid pipe or other structures shall be designed to accommodate differential movements and stress concentrations.

For dams 20 ft or less in effective height, acceptable pipe materials are cast-iron, steel, corrugated steel, ductile iron or aluminum, asbestos-cement, concrete, plastic, excluding corrugated high density polyethylene (HDPE), vitrified clay with rubber gaskets, and cast-in-place reinforced concrete. Asbestos-cement, concrete, and vitrified clay pipe shall be laid in a concrete bedding. Plastic pipe that will be exposed to direct sunlight shall be made of ultraviolet-resistant materials and protected by coating or shielding, or provisions for replacement should be made as necessary. Connections of plastic pipe to less flexible pipe or structures must be designed to avoid stress concentrations that could rupture the plastic.

For dams more than 20 ft in effective height, conduits shall be plastic, reinforced concrete, cast-in-place reinforced concrete, corrugated steel, ductile iron or aluminum, or welded steel pipe. The maximum height of fill over any principal spillway steel or aluminum pipe must not exceed 25 ft. Pipe shall be watertight. The joints between sections of pipe shall be designed to remain watertight after joint elongation caused by foundation consolidation. Concrete pipe shall have concrete bedding or a concrete cradle, if required. Cantilever outlet sections, if used, shall be designed to withstand the cantilever load. Pipe supports shall be provided when needed. Other suitable devices such as a Saint Anthony Falls stilling basin or an impact basin may be used to provide a safe outlet. Protective coatings of asbestos-bonded, asphalt coated, or vinyl coating on galvanized corrugated metal pipe, or coal tar enamel on welded steel pipe should be provided in areas that have a history of pipe corrosion, or where the saturated soil resistivity is less than 4,000 ohms-cm, or where soil pH is lower than 5.

Specifications in Tables 3 and 4 are to be followed for polyvinyl chloride (PVC), steel, and aluminum pipe.

Cathodic protection. Cathodic protection is to be provided for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating, and where the need and importance of the structure warrant additional protection and longevity. If cathodic protection is not provided for in the original design and installation, electrical continuity in the form of joint-bridging straps should be considered on pipes that have protective coatings. Cathodic protection should be added later if monitoring indicates the need.

Practice standard 430-FF provides criteria for cathodic protection of welded steel pipe.

Table 3 - Acceptable PVC Pipe for Use in Earth Dams[1]

Nominal pipe size (inches)	Schedule for standard dimension ratio (SDR)	Maximum depth of fill over pipe (feet)
4 or less	Schedule 40	15
	Schedule 80	20
	SDR 26	10
6,8,10,12	Schedule 40	10
	Schedule 80	15
	SDR 26	10

[1]Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ATSM-D-1785 or ATSM-D-2241.

Table 4 - Minimum Gage for Corrugated Metal Pipe (2-2/3-in x ½-in Corrugations)[1]

	Steel pipe diameter (in)					
Fill height (ft)	21 and less	24	30	36	42	48
1 - 15	16	16	16	14	12	10
15 - 20	16	16	16	14	12	10
20 - 25	16	16	14	12	10	10

	Aluminum pipe[2] diameter (in)			
Fill height (ft)	21 and less	24	30	36
1 - 15	0.06	0.06	0.075	0.075
15 - 20	0.06	0.075	0.105	0.105
20 - 25	0.06	0.105	0.105	----[3]

1 Pipe with 6-, 8-, and 10-in diameters has 1-1/2 in x ¼-in corrugations.

2 Riveted or helical fabrication.

3 Not permitted.

Seepage control. Seepage control along a pipe conduit spillway shall be provided if any of the following conditions exist:

1. The effective height of dam is greater than 15 ft.
2. The conduit is of smooth pipe larger than 8 in. in diameter.
3. The conduit is of corrugated pipe larger than 12 in. in diameter.

Seepage along pipes extending through the embankment shall be controlled by use of a filter and drainage diaphragm, unless it is determined that antiseep collars will adequately serve the purpose

The drain is to consist of sand, meeting fine concrete aggregate requirements (at least 15% passing the No. 40 sieve but no more than 10% passing the No. 100 sieve). If unusual soil conditions exist, a special design analysis shall be made.

The drain shall be a minimum of 2 ft thick and extend vertically upward and horizontally at least three times the pipe diameter, and vertically downward at least 18 in. beneath the conduit invert. The drain diaphragm shall be located immediately downstream of the cutoff trench, approximately parallel to the centerline of the dam.

The drain shall be outletted at the embankment downstream toe, preferably using a drain backfill envelope continuously along the pipe to where it exits the embankment. Protecting drain fill from surface erosion will be necessary.

When antiseep collars are used in lieu of a drainage diaphragm, they shall have a watertight connection to the pipe. Maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. Collar material shall be compatible with pipe materials. The antiseep collar(s) shall increase by 15% the seepage path along the pipe.

Closed conduit spillways designed for pressure flow must have adequate antivortex devices.

Trash guard. To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser.

Other outlets. A pipe with a suitable valve shall be provided to drain the pool area if needed for proper pond management or if required by State law. The principal spillway conduit may be used as a pond drain if it is located where it can perform this function.

Supply pipes through the dam to watering troughs and other appurtenances shall have an inside diameter of not less than 1-1/4 inches and have at least one anti-seep collar or PVC diaphragm placed along the outlet third of the pipe.

Auxiliary spillways. Auxiliary spillways convey large flood flows safely past earth embankments.

An auxiliary spillway must be provided for each dam, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The following are minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway: a conduit with a cross-sectional area of 3 square feet or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

The minimum capacity of a natural or constructed auxiliary spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in Table 5, less any reduction creditable to conduit discharge and detention storage.

The auxiliary spillway shall safely pass the peak flow, or the storm runoff shall be routed through the reservoir. The routing shall start either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days of drawdown, whichever is higher. The 10-day drawdown shall be computed from the crest of the auxiliary spillway or from the elevation that would be attained if the entire design storm were impounded, whichever is lower. Auxiliary spillways shall provide for passing the design flow at a safe velocity to a point downstream where the dam will not be endangered.

Constructed auxiliary spillways are open channels that usually consist of an inlet channel, a control section, and an exit channel. They shall be trapezoidal and shall be located in undisturbed or compacted earth. The side slopes shall be stable for the material in which the spillway is to be constructed. For dams having an effective height exceeding 20 ft, the

auxiliary spillway shall have a bottom width of not less than 10 ft.

Upstream from the control section, the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed auxiliary spillway shall fall within the range established by discharge requirements and permissible velocities.

Structural auxiliary spillways. If chutes or drops are used for principal spillways or auxiliary spillways, they shall be designed according to the principles set forth in the Engineering Field Handbook for Conservation Practices and the National Engineering Handbook-Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in table 5, less any reduction creditable to conduit discharge and detention storage.

Table 5 - Minimum Spillway Capacity

Dam Height[1]	Storage[2]	Design Storm Frequency		Minimum Duration
		Service	Auxiliary	
ft	gallons	yr	yr	hr
<6	any	2	10	24
6-15	<3 million	2	25	24
6-15	>3 million	5	100	24
>15	<1 million	5	50	24
>15	any	5	100	24

[1] As defined under “Scope.”
[2] Measured to top of dam

Criteria for Excavated Ponds

Runoff. Provisions shall be made for a pipe and auxiliary spillway if necessary. Runoff flow patterns shall be considered when locating the pond and placing the spoil (see Table 5).

Side slopes. Side slopes of excavated ponds shall be stable and shall not be steeper than one horizontal to one vertical.

Perimeter form. If the structures are to be used for recreation or are highly visible to the public, the perimeter or edge should be curvilinear.

Inlet protection. If surface water enters the pond in a natural or excavated channel, the side slope of the pond shall be protected against erosion.

Excavated material. The material excavated from the pond shall be placed so that its weight will not endanger the stability of the pond side slopes and so that it will not be washed back into the pond by rainfall. It shall be disposed of in one of the following ways:

1. Uniformly spread to a height that does not exceed 3 ft, with the top graded to a continuous slope away from the pond.
2. Uniformly placed or shaped reasonably well, with side slopes assuming a natural angle of repose. The excavated material will be placed at a distance equal to the depth of the pond but not less than 12 ft from the edge of the pond.
3. Shaped to a designed form that blends visually with the landscape.
4. Used for low embankment and leveling.
5. Hauled away.

Additional Criteria to Provide Water for Livestock

At least 25% of the surface area shall have a minimum depth of 6 feet. When the underlying material prevents excavation to the 6 foot depth, at least 50% of the surface area shall have a minimum depth of 4 feet.

If livestock are to water directly from the pond, an approach ramp shall be provided with a slope no steeper than four horizontal to one vertical. It shall be graveled, paved, or otherwise prepared to provide solid footing and shall be a minimum of 16 feet wide.

Additional Criteria to Provide Water for Fish and Wildlife

Table 6 displays design criteria for ponds created primarily for the production and management of fish for sport fishing. For the production of bait fish, see conservation practice standard 397, Commercial Fishponds. For other wildlife species, see conservation practice standard Upland Wildlife Habitat Management (645) and Wetland Wildlife Habitat Management (644).

Shore vegetation shall be planned as appropriate to the wildlife objectives of the pond.

Table 6
Minimum Surface Area and Depth

Species	Surface Area at Normal Water Level	Depth for at Least 25% of Surface Area
Trout	¼ ac. (0.25) 1/6 ac. (0.17)	10 ft. 8 ft. (with strong springs)
Bass Alone	1/6 ac. (0.17)	8 ft.
Bass and Golden Shiners	1/6 ac. (0.17)	8 ft.
Bass and Bluegills	1/3 ac. (0.33)	8 ft.

Drain pipe. A drain pipe shall be installed in all embankment fish ponds to facilitate management. It should be of sufficient size to drain the pond in ten days and located in the lowest point along the centerline of the embankment to remove as much water as practicable.

Supplemental water supply. Precautions must be taken in the use of supplemental water to keep out trash fish and other contaminants. Ponds constructed near a natural stream will be provided protection against flooding for a 10-year 24 hour frequency storm. Water diverted from a stream must be piped into the pond and pass through either:

1. A properly designed fish trap which requires a 2 foot drop from the supply pipe to normal water level
2. A saran microfilament screen or its equivalent (see NRCS Technical Note Biology #8)

The minimum size inlet pipe will be that which is adequate to maintain the desired water level in the pond. A device must be provided to regulate the intake flow of water when necessary. Galvanized or copper pipe must not be used if trout are to be stocked in the pond. Entrance to inlet pipe should be protected from sediment and debris by:

1. Installing the inlet pipe so that it is 90 degrees to the stream flow, or pointing slightly downstream.
2. Using a right angle elbow placed in deep water a minimum of one foot above the streambed and pointed towards the bottom.
3. A cleanout box is desirable at some point along the pipeline.

The outlet for all fish ponds shall be constructed to prevent fish from swimming upstream into the pond.

Additional Criteria to Provide Fire Protection

Capacity. The minimum capacity of the reservoir shall be one-fourth acre-

foot. In some cases, it may be desirable to compute the capacity based in hours of pumping time to account for evaporation and ice; the volume will be computed from 2 feet below the normal water elevation to 1 foot above the hydrant intake.

Depth. The minimum depth will be eight feet for 25 percent of the surface area, or 0.1 acre, whichever is smaller.

Location. The pond will be located adjacent to an all-weather road.

Access to Water. Access to water shall be provided by the installation of a suitable hydrant (pressure or dry), or other acceptable method.

A fire protection pond may serve as a source of supply for local fire departments when accessible to large tank trucks. When used for this purpose, hydrant fittings shall be designed to fit local fire company equipment. To make best use of these installations, the fire department shall be kept up-to-date on the location of installations accessible to their equipment. Refer to conservation practice standard Dry Hydrant 432.

CONSIDERATIONS

Consider installing fence to control livestock access to the pond.

Consider developing alternative watering facilities using water from the pond rather than allowing animals to drink directly from the pond.

When pond will be used to provide fire protection, consider locating pond within 75 feet from the nearest building and a maximum distance of 1000 feet from the farthest building to be protected.

Visual resource design. The visual design of ponds shall be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness.

The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

The embankment may be shaped to blend with the natural topography. The edge of the pond may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, islands may be added for visual interest and to attract wildlife

Water Quantity

1. Effects upon components of the water budget, especially effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Variability of effects caused by seasonal or climatic changes.
3. Effects on the downstream flows or aquifers that could affect other water uses or users.
4. Potential for multiple use.
5. Effects on the volume of downstream flow to prohibit undesirable environmental, social or economic effects.

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment attached substances that are carried by runoff.
2. Effects on the visual quality of onsite and downstream water resources.
3. Short-term and construction-related effects of this practice on the quality of downstream water courses.
4. Effects of water level control on the temperatures of downstream water

to prevent undesired effects on aquatic and wildlife communities.

5. Effects on wetlands and water-related wildlife habitats.
6. Effects of water levels on soil nutrient processes such as plant nitrogen use or denitrification.
7. Effects of soil water level control on the salinity of soils, soil water, or downstream water.
8. Potential for earth moving to uncover or redistribute toxic materials such as saline soils.
9. Consider the effects of locating a pond below septic fields, concentrated waste areas, excessively eroding areas and other pollution sources, particularly when high water quality for recreation or fish production is a concern.

PLANS AND SPECIFICATIONS

Plans and specifications for installing ponds shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and reviewed with the landowner or individual responsible for the operation and maintenance. The plan shall include the maintenance of the embankment, if present, to the required shape and height. It shall include the periodic removal of woody vegetation that may become established on the embankment. Provisions for maintenance access must be provided.

Erosion and sediment control structures will be maintained periodically and after every major runoff event until the disturbed area is fully protected.

NHCP, NRCS NY
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REFERENCES

Guidelines for Design of Dams, Rev. Jan. 1989, NYS DEC

NYS Consolidated Laws, Environmental Conservation Title 5, Protection of Water, Section 15-0503, Protection of Water Bodies; Permit

Article 15 Environmental Conservation Law, 6NYCRR, Part 608, Protection of Waters

http://www.dec.state.ny.us/website/dcs/streamprotection/index.html

New York Standards and Specifications for Erosion and Sediment Control (blue book)